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FINDLEY, CHRISTOPHER O

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

	Application No.	**Applicant(s)**
Office Action Summary	10/797,635	RIDGE ET AL.
	Examiner	**Art Unit**	
	CHRISTOPHER FINDLEY	2621	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>29 December 2008</u>.

2a)☒ This action is **FINAL**.   2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) <u>3-17,20-23,25 and 27-33</u> is/are pending in the application.

     4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) <u>3-17,20-23,25 and 27-33</u> is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

     a)☐ All b)☐ Some * c)☐ None of:

         1.☐ Certified copies of the priority documents have been received.

         2.☐ Certified copies of the priority documents have been received in Application No. _____.

         3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

     * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5)☐ Notice of Informal Patent Application

6)☐ Other: _____.

DETAILED ACTION

Response to Arguments

1.   Applicant's arguments filed 12/29/2008 have been fully considered but they are
not persuasive.

2.   Re claims 4 and 21, the Applicant contends that the predictive macroblock
generators according to Koto cannot be used to compute the sum of absolute
differences, and therefore if the SAD calculation, according to Kim, is applied to the
encoders as disclosed in Koto, all the predictive macroblock generators in Figures 1, 2,
3, 8, 9 and 19 in Koto must be removed, and new and different predictive macroblock
generators must be provided. However, the Examiner respectfully disagrees. Koto
discloses "calculating a linear sum of the reference macroblocks using weighting factors
to generate a predictive macroblock" (Koto: paragraph [0012]). Koto more specifically,
with reference to Fig. 1, states, "The predictive macroblock selector 120 calculates the
difference between each of the predictive macroblock signals 130 to 133 generated by
the predictive macroblock generator 119 and the video macroblock signal extracted
from the input video signal 100, and selects one of the predictive macroblock signals
which exhibits a minimum error for each video macroblock" (Koto: paragraph [0059]),
indicating calculating a difference. Calculating a sum of absolute differences, as
disclosed by Kim, is a linear operation and also falls under the characterization of
calculating a difference disclosed by Koto.

      Furthermore, Koto states, "It is an object of the present invention to suppress
increases in computation amount and the overhead for predictive picture encoded data,

while greatly improving prediction efficiency, in video encoding and decoding…" (Koto:

paragraph [0010]). Kim similarly describes its goal as providing "adaptive quantization

for macroblocks while maintaining the bit budget for the frame," thereby reducing

computational complexity (Kim: paragraph [0024]). The Examiner submits that the

reduction of computational overhead described in Kim is analogous to the goal of

improving efficiency described in Koto, and, therefore, the combination of Koto and Kim

does not change the principle of either reference since the principles are the same.

3.   Re claims 7 and 28, the Applicant contends that Koto does not disclose using an

index to indicate the variance in the block differences. However, as also noted by the

Applicant said limitation was not previously presented, and thus has been addressed in

the new rejection included below.

4.   Re claims 10, 15, 29, and 30, the Applicant contends that Koto does not disclose

that the reference frames are divided into sub-groups and the minimum shift is obtained

for each sub-group. However, the Examiner respectfully disagrees. The reference

frames each with a unique code number may be considered a sub-group of the

complete set of reference frames. The claim language does not preclude sub-groups

consisting of single frames.

5.   Re new claims 32 and 33 (erroneously referred to as claims 31 and 32 in the

Applicant's Remarks), the Applicant contends that the prior art cited fails to teach or

suggest the limitation that the weighted sum is determined at least partially based on a

quantizer parameter of the reference frame. However, as also noted by the Applicant

said limitation was not previously presented, and thus has been addressed in the new

rejection included below.

Claim Rejections - 35 USC § 103

6.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set
>
> forth in section 102 of this title, if the differences between the subject matter sought to be patented and
>
> the prior art are such that the subject matter as a whole would have been obvious at the time the
>
> invention was made to a person having ordinary skill in the art to which said subject matter pertains.
>
> Patentability shall not be negatived by the manner in which the invention was made.

7.   **Claims 3-7, 9-17, 20-23, 25, and 27-33 are rejected under 35 U.S.C. 103(a) as**

being unpatentable over Koto et al. (US 20030215014) in view of Kim et al. (US

20030123539 A1).

        Re **claim 4**, Koto discloses a method, comprising: selecting M reference frames

for a given original video frame from a video sequence having a plurality of video

frames, each frame containing a plurality of coefficients, wherein M is a positive integer

equal to or greater than 1 (Koto: Fig. 11); partitioning said original video frame into

rectangular blocks of coefficients (Koto: Abstract section); and from each of the M

reference frames: forming at least one reference block of coefficients from an offset of

the rectangular blocks (Koto: Fig. 12, the frames are partitioned into blocks and motion

vectors indicate offsets); and obtaining a block difference at least partially based on a

summation of differences between individual coefficients in each of said rectangular

blocks of coefficients and corresponding individual coefficients in said at least one

reference block of coefficients (Koto: paragraph [0059]); and optimizing the offset at

least partially based on the block difference (Koto: paragraph [0146]).

Koto does not specifically disclose using the absolute values of the differences

between corresponding individual coefficients in each of said rectangular blocks of

coefficients and said at least one reference block of coefficients. However, Kim

discloses a method and apparatus for video bit-rate control, wherein motion vectors are

computed by a sum-of-absolute-difference (SAD) based block matching scheme (Kim:

paragraph [0017]) and the SAD calculation compares current and reconstructed

previous luminance samples on a pixel-by-pixel basis (Kim: Equation [2]; paragraphs

[0018]-[0022]). Since both Koto and Kim relate to the coding of video sequences with

predictive motion information, one of ordinary skill in the art at the time of the invention

would have found it obvious to combine the SAD calculation of Kim with the coding

scheme of Koto in order to provide a system capable of adaptive quantization, thus

allowing the system to operate at a reduced computational complexity while still

maintaining a target bit budget (Kim: paragraph [0024]). The combined system of Koto

and Kim has all of the features of claim 4.

Re **claim 3**, the combined system of Koto and Kim discloses a majority of the

features of claim 3, as discussed above in claim 4. Additionally, Koto discloses that for

each of said rectangular blocks of coefficients and each permutation of a horizontal

offset value X and a vertical offset value Y, obtaining M additional rectangular blocks of coefficients for providing M reference blocks, wherein each of said M reference blocks of coefficients is formed by selecting coefficients from the M reference frames, such that the coefficients in the M reference blocks of coefficients are horizontally offset by distance X and vertically offset by distance Y from a corresponding coefficient in said rectangular block of coefficients (Koto: paragraph [0146], candidate motion vectors are scaled according to inter-frame distance, leaving only a 2-dimensional (x, y) offset).

Re **claim 5**, the combined system of Koto and Kim discloses a majority of the features of claim 5, as discussed above in claim 4. Additionally, Koto discloses for each of said rectangular blocks of coefficients, determining an optimal horizontal offset X and vertical offset Y, wherein said determining is based at least partially on minimizing a weighted sum of M block differences (Koto: paragraph [0013]).

Re **claim 6**, the combined system of Koto and Kim discloses a majority of the features of claim 6, as discussed above in claim 4. Additionally, Koto discloses that each of the M video frames selected as the M reference frames is computed based on the same frame of original video (Koto: Fig. 12).

Re **claim 9**, the combined system of Koto and Kim discloses a majority of the features of claim 9 as discussed above in claim 5. Koto does not explicitly disclose that motion is represented by a motion vector to be encoded in bits, and wherein said determining is also based on the number of bits needed to encode the motion vector. However, Kim discloses a method and apparatus for video bit-rate control, wherein

motion vectors are selected based on the displacement of the search point that results

in a minimum SAD among the SAD values in the search space, and the information

provided by the SAD may be utilized for bit-rate control (Kim: paragraph [0023]). Since

both Koto and Kim relate to the coding of video sequences with predictive motion

information, one of ordinary skill in the art at the time of the invention would have found

it obvious to combine the SAD calculation of Kim with the coding scheme of Koto in

order to provide a system capable of adaptive quantization, thus allowing the system to

operate at a reduced computational complexity while still maintaining a target bit budget

(Kim: paragraph [0024]). The combined system of Koto and Kim has all of the features

of claim 9.

Re **claim 10**, the combined system of Koto and Kim discloses a majority of the

features of claim 10, as discussed above in claim 5. Additionally, Koto discloses that

the set of M reference frames is divided into N sub-sets, such that each of the M

reference frames belongs to precisely one of the N sub-sets, and wherein the process

of determining the optimal horizontal offset X and vertical offset Y is repeated for each

of said N sub-sets of reference frames, for indicating a set of N optimal horizontal

offsets X and N vertical offsets Y (Koto: Fig. 11, MPEG may use a linear prediction

scheme, allowing a group of pictures (GOP) may be divided into subgroups).

Re **claim 11**, the combined system of Koto and Kim discloses a majority of the

features of claim 10, as discussed above in claim 5. Additionally, Koto discloses that

said determining of the optimal horizontal offset X and optimal vertical offset Y involves

a discrimination against offsets with large magnitudes (Koto: paragraph [0146], the minimum value is sought).

Re **claim 12**, the combined system of Koto and Kim discloses a majority of the features of claim 12, as discussed above in claim 11. Additionally, Koto discloses that the discrimination is at least partially dependent upon an index corresponding to which of the M reference frames is being considered (Koto: paragraph [0146], candidate motion vectors are scaled according to inter-frame distance).

Re **claim 13**, the combined system of Koto and Kim discloses a majority of the features of claim 13, as discussed above in claim 10. Additionally, Koto discloses that the number N may vary from one frame of video to another frame of video (Koto: Fig. 11, the number of reference frames may vary as well as the number and type of frames in a GOP, allowing the number of subsets to vary accordingly).

Re **claim 14**, the combined system of Koto and Kim discloses a majority of the features of claim 14 as discussed in claims 4, 5 and 11 above, but neither Koto nor Kim explicitly discloses that the number N may vary from one frame of video to another frame of video, and the determination of the number N involves analysis of block differences in the previous frame. However, the Examiner takes Official Notice that one of ordinary skill in the art at the time of the invention would have found it obvious that a scene change may truncate a GOP, as is well known for instance to implement frame dropping rate control, therefore causing the GOP to contain less reference frames than is typical.

Re **claim 15**, the combined system of Koto and Kim discloses a majority of the features of claim 15, as discussed above in claim 4. Additionally, Koto discloses that for each rectangular block, the set of M reference blocks is divided into N sub-sets, such that each of the M reference blocks belongs to precisely one of the N sub-sets, and wherein the process of determining the optimal horizontal offset X and vertical offset Y is repeated for each of said N sub-sets of reference blocks, for indicating a set of N optimal horizontal offsets X and N vertical offsets Y (Koto: Fig. 11, MPEG may use a linear prediction scheme, allowing a group of pictures (GOP) may be divided into subgroups, and, in turn, dividing the number of reference blocks as well).

Re **claim 16**, the combined system of Koto and Kim discloses a majority of the features of claim 16, as discussed above in claim 15. Additionally, Koto discloses that the number N of sub-sets may vary from one block to another within the given frame of video, said variation either based upon explicit signaling in the encoded bit stream or upon a deterministic algorithm (Koto: Fig. 11, the number of reference frames (explicitly indicated by the Code_number) may vary as well as the number and type of frames in a GOP, allowing the number of subsets to vary accordingly).

Re **claim 17**, the combined system of Koto and Kim discloses a majority of the features of claim 17 as discussed in claims 4 and 15-16 above, but neither Koto nor Kim explicitly discloses that the size of a rectangular block in one of the N sub-sets is computed at least partially using the size of a rectangular block in another of the N sub-sets or the values of the horizontal offsets X and vertical offsets Y. However, the Examiner takes Official Notice that one of ordinary skill in the art at the time of the

invention would have found it obvious that a search block in a reference frame typically

occupies an area that is a multiple of the size of the target block, as is well known.

    Claim 20 has been analyzed and rejected with respect to claim 3 above.

    Re **claim 21**, Koto discloses an apparatus, comprising: a motion estimation

module, responsive to an input signal indicative of an original frame in a video

sequence, for providing a set of predictions so as to allow a prediction module to form a

predicted image, wherein the video sequence including a plurality of video frames, each

frame containing a plurality of coefficients at different locations of the frame (Koto: Fig.

1, element 119); and a combining module, responsive to the input signal and the

predicted image, for providing residuals for encoding (Koto: Fig. 1, element 119),

wherein the motion estimation block is configured for selecting M reference frames for a

given original video frame in said plurality of video frames, wherein M is a positive

integer equal to or greater than 1 (Koto: Fig. 11); partitioning said original video frame

into rectangular blocks of coefficients (Koto: Abstract section); and from each of the M

reference frames: forming at least one reference block of coefficients from an offset of

the rectangular blocks (Koto: Fig. 12, the frames are partitioned into blocks and motion

vectors indicate offsets); and computing the differences between said at least one

reference block and the rectangular blocks (Koto: paragraph [0059]); and optimizing the

offset (Koto: paragraph [0146]).

    Koto does not specifically disclose using the absolute values of the differences

between corresponding individual coefficients in each of said rectangular blocks of

coefficients and said at least one reference block of coefficients. However, Kim

discloses a method and apparatus for video bit-rate control, wherein motion vectors are computed by a sum-of-absolute-difference (SAD) based block matching scheme (Kim: paragraph [0017]) and the SAD calculation compares current and reconstructed previous luminance samples on a pixel-by-pixel basis (Kim: Equation [2]; paragraphs [0018]-[0022]). Since both Koto and Kim relate to the coding of video sequences with predictive motion information, one of ordinary skill in the art at the time of the invention would have found it obvious to combine the SAD calculation of Kim with the coding scheme of Koto in order to provide a system capable of adaptive quantization, thus allowing the system to operate at a reduced computational complexity while still maintaining a target bit budget (Kim: paragraph [0024]). The combined system of Koto and Kim has all of the features of claim 21.

Claim 22 has been analyzed and rejected with respect to claim 5 above.

Claim 23 recites the corresponding software program embedded in a computer readable storage medium for implementing the method of claim 4, and, therefore, has been analyzed and rejected with respect to claim 4 above.

Claim 25 has been analyzed and rejected with respect to claim 3 above.

Claim 27 has been analyzed and rejected with respect to claim 5 above.

Claim 29 has been analyzed and rejected with respect to claim 10 above.

Claim 30 has been analyzed and rejected with respect to claim 15 above.

Re **claim 31**, the combined system of Koto and Kim discloses a majority of the features of claim 31, as discussed above in claim 6. Additionally, Koto discloses that M is greater than 1 and the block differences for the M reference blocks are combined for providing a weighted sum having a plurality of weighting factors, and wherein each weighting factor in the weighted sum is determined at least partially based upon residual energy of a previous video frame (Koto: Fig. 11, Code_number 0 indicates multi-reference prediction).

Re **claim 32**, the combined system of Koto and Kim discloses a majority of the features of claim 32, as discussed above in claim 4. Koto further discloses using weighting factors in generating a predictive macroblock (Koto: Fig. 33 and paragraph [0180]), but Koto does not explicitly disclose that each weighting factor in the weighted sum is determined at least partially based upon a quantizer parameter of the reference frame subjected to that weight.   However, Kim discloses a scheme for meeting a bit budget, wherein frames and blocks are grouped into different classes according to activity levels, and a quantization parameter is applied depending on the activity level (Kim: paragraphs [0035] and [0036]), where the quantization parameter acts as a weight for determining whether the block meets the desired target budget. A relationship between the quantization parameter and the SAD value is also disclosed (Kim: paragraphs [0025] and [0026]). Furthermore, the quantization parameter is assigned to a specific macroblock using a dquant equation that takes into account a quantization parameter for a previous block (Kim: paragraph [0040]). Since both Koto and Kim relate to the coding of video sequences with predictive motion information, one of ordinary skill

in the art at the time of the invention would have found it obvious to combine the SAD

calculation of Kim with the coding scheme of Koto in order to provide a system capable

of adaptive quantization, thus allowing the system to operate at a reduced

computational complexity while still maintaining a target bit budget (Kim: paragraph

[0024]).

Re **claim 33**, the combined system of Koto and Kim discloses a majority of the

features of claim 33, as discussed above in claim 25. Koto further discloses using

weighting factors in generating a predictive macroblock (Koto: Fig. 33 and paragraph

[0180]), but Koto does not explicitly disclose that each weighting factor in the weighted

sum is determined at least partially based upon a quantizer parameter of the reference

frame subjected to that weight. However, Kim discloses a scheme for meeting a bit

budget, wherein frames and blocks are grouped into different classes according to

activity levels, and a quantization parameter is applied depending on the activity level

(Kim: paragraphs [0035] and [0036]), where the quantization parameter acts as a weight

for determining whether the block meets the desired target budget. A relationship

between the quantization parameter and the SAD value is also disclosed (Kim:

paragraphs [0025] and [0026]). Furthermore, the quantization parameter is assigned to

a specific macroblock using a dquant equation that takes into account a quantization

parameter for a previous block (Kim: paragraph [0040]). Since both Koto and Kim relate

to the coding of video sequences with predictive motion information, one of ordinary skill

in the art at the time of the invention would have found it obvious to combine the SAD

calculation of Kim with the coding scheme of Koto in order to provide a system capable

of adaptive quantization, thus allowing the system to operate at a reduced

computational complexity while still maintaining a target bit budget (Kim: paragraph

[0024]).

8.   **Claims 7 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable**

over Koto et al. (US 20030215014) in view of Kim et al. (US 20030123539 A1) as

applied to claims 3-6, 9-17, 20-23, 25, 27, and 29-33 above, and further in view of

Wiegand et al. (US 6,807,231 B1).

Re **claim 7**, the combined system of Koto and Kim discloses a majority of the

features of claim 7, as discussed above in claim 4. Additionally, Koto discloses that the

block differences for the M reference blocks are combined for providing a weighted sum

having a plurality of weighting factors, and wherein each weighting factor in the

weighted sum is determined at least partially based upon an index of the reference

frame subjected to that weight (Koto: paragraphs [0081]-[0084]).

Neither Koto nor Kim specifically discloses that the index is indicative of a

variance in the block difference. However, Wiegand discloses a multi-hypothesis

motion-compensated video image predictor, wherein n hypotheses are found for each

predicted block (Wiegand: column 9, lines 27-30) and for each n-hypothesis component

in each iteration, the Optimal Hypothesis Selection Algorithm (OHSA) performs a full

search within a conditional search space in which an optimal conditional n-hypothesis

component is to be found (Wiegand: column 9, lines 60-63). The algorithm further

includes minimizing an expression involving the scalar variance of the original block

(Wiegand: column 10, lines 19-32 and Equation 13). Since Koto, Kim, and Wiegand all

relate to motion vector selection techniques, one of ordinary skill in the art at the time of

the invention would have found it obvious to combine the iterative searching of Wiegand

with the combined system of Koto and Kim in order to minimize a cost function

(Wiegand: column 3, lines 21-25).

  Claim 28 has been analyzed and rejected with respect to claim 7 above.

9. **Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Koto
et al. (US 20030215014) in view of Kim et al. (US 20030123539 A1), as applied to
claims 3-6, 9-17, 20-23, 25, 27, and 29-33, and further in view of Wu et al. (US
6700933 B1).**

  Re **claim 8**, the combined system of Koto and Kim discloses a majority of the

features of claim 8 as discussed in claim 4 above, but neither Koto nor Kim explicitly

discloses that each of the M video frames selected as the M reference frames is

computed by decoding the same frame of original video at a variety of quality settings.

However, Wu discloses a method with advance predicted bit-plane coding for

progressive fine-granularity scalable (PFGS) video coding, where different layers are

used for different quality of video (Wu: Fig. 23). Since Koto, Kim, and Wu all employ

motion estimation/compensation (Koto: Abstract section; Wu: Fig. 19, elements 204,

206, and 207), one of ordinary skill in the art at the time of the invention would have

found it obvious to combine the bit-plane coding of Wu with the combined system of

Koto and Kim in order to provide a robust coding scheme which adapts to bandwidth

fluctuation and also exhibits good error recovery characteristics (Wu: column 3, lines

27-29). The combined system of Koto, Kim, and Wu has all of the features of claim 8.

Conclusion

10.   The prior art made of record and not relied upon is considered pertinent to

applicant's disclosure:

    a.   Multiple frame motion estimation

    Lavagetto et al. (US 5151784 A)

    b.   Method and apparatus for weighted prediction estimation using a

    displaced frame differential

    Yin et al. (US 20060198440 A1)

11.   Applicant's amendment necessitated the new ground(s) of rejection presented in

this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37

CFR 1.136(a).

    A shortened statutory period for reply to this final action is set to expire THREE

MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later

than SIX MONTHS from the date of this final action.

Contact

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to CHRISTOPHER FINDLEY whose telephone number is

(571)270-1199. The examiner can normally be reached on Monday-Friday (8:30 AM-

5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Marsha D. Banks-Harold can be reached on 571-272-7905. The fax phone

number for the organization where this application or proceeding is assigned is 571-

273-8300.

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/Marsha D. Banks-Harold/
Supervisory Patent Examiner, Art Unit 2621

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